WE CLAIM

1. A method for automatically routing and switching a connection in a WDM network, comprising:

receiving a request for connecting a source node and a destination node;

engineering a plurality of viable regenerator paths between said source and destination nodes, based on constraints in said request and on current network configuration and loading; and

selecting a best path from said plurality of regenerator paths to serve said connection.

2. A method as claimed in claim 1, wherein said step of engineering comprises:

constructing 'n' valid link paths for connecting said source node and said destination node based on constraints in said request and on the current network configuration;

for each valid link path, configuring 'm' groups of viable regenerator paths corresponding to a respective associated link path, based on current regenerator availability data and operational parameters of said regenerators;

wherein 'n' and 'm' are selected for said WDM networks.

3. A method as claimed in claim 1, wherein said step of selecting comprises sorting said viable regenerator paths based on an estimated performance parameter.

4. A method as claimed in claim 3, wherein said estimated performance parameter is one of an estimated Q, a cost function and both an estimated Q and a cost function.

5. A method as claimed in claim 2, wherein said step of constructing 'n' valid link paths comprises:

constructing a path search tree comprising all link paths that originate at said source node and sink into said destination node, starting from said source node; and

for each link path, calculating a path weight and selecting said valid link paths according to said path weight.

6. A method as claimed in claim 5, further comprising interrupting construction of said path search tree when 'n' said valid paths have been selected.

7. A method as claimed in claim 5, further comprising abandoning a link path whenever a link on said link path is incompatible with a target link weight.

8. A method as claimed in claim 2, wherein said constraints include: specific nodes that must be in a link path, specific nodes that must not be in a link path, specific links that must be in a link path, specific links that must not be in a link path, a link path that must be avoided, and a link path that must be followed.

9. A method as claimed in claim 5, wherein said path weight is a path cost function.

10. A method as claimed in claim 9, wherein said path cost function comprises the cost of said source node, the cost of said destination node, the estimated cost of all regenerators switched in said valid link path, and the sum of link weights for all links of said valid link path.

11. A method as claimed in claim 2, comprising, for the case when 'n' valid link paths cannot be constructed, processing as many valid link paths as could be constructed.

12. A method as claimed in claim 2, wherein said step of configuring 'm' groups of viable regenerator paths comprises:

collecting regenerator availability data;

constructing a plurality of regenerator paths including a regenerator at (k) nodes along said associated link path, wherein k is an integer between 0 and the number of links along said associated link path; and

grouping said regenerator paths according to the number 'k' of regenerators.

13. A method as claimed in claim 12, wherein said step of constructing a plurality of regenerator paths comprises:

constructing a regenerator search tree for said associated link path, comprising all combinations of regenerator placement at intermediated nodes;

(a) abandoning a regenerator path whenever the length of the link between said source node and a next node in said associated link path is beyond the reach of all available transponders at said source node;

(b) abandoning a regenerator path whenever the length of a link between any intermediate node and the next node along said associated link path is beyond the reach of all available regenerators at said intermediate node;

(c) abandoning a regenerator path whenever a connection cannot be established between a last intermediate node and said destination node; and

(d) storing all regenerator paths other than said regenerator paths abandoned at (a), (b) and (c) as viable regenerator paths.

14. A method as claimed in claim 2, wherein said step of configuring comprises:

constructing a regenerator search tree for said associated link path, comprising all combinations of regenerator placement at intermediated nodes; an

storing a plurality of viable regenerator paths obtained by applying regenerator placement rules to said search tree; and

assigning a set of wavelengths to each said viable regenerator path based on wavelength rules and on current network loading data.

15. A method as claimed in claim 14, wherein said set of wavelengths comprises a wavelengths for each segment of between two consecutive regenerators.

16. A method as claimed in claim 3, wherein said step of sorting said regenerator paths comprises:

ordering said viable regenerator paths in a matrix according to the number of regenerators; and

determining said estimated performance parameter of each said viable regenerator path in said matrix in a specific sequence, using an estimating tool.

17. A method as claimed in claim 16, wherein said specific sequence comprises:

estimating said performance parameter for each path in said matrix in order, beginning with a path with no regenerators; and

declaring a viable regenerator path having said estimated performance parameter above a threshold as said best path.

18. A method as claimed in claim 17, wherein said specific sequence is selected according to a probability of success function.

19. A method for automatically routing and switching a connection in a WDM network, comprising:

engineering a plurality of viable regenerator paths between a source and a destination node, based on user constraints, current network configuration and on regenerator placement rules;

assigning a set of wavelengths to each said viable regenerator path based on wavelength rules and on current network loading; and

selecting a best path from said plurality of regenerator paths to serve said connection.

20. A method as claimed in claim 19, further comprising attempting to setup said connection along said best path.

21. A method as claimed in claim 20, wherein said step of attempting to setup said connection comprises;

turning on said regenerator path based on a slow turn-on procedure for reducing transience in the network and allowing performance data collection for all established link paths that share a link with said best path;

once said regenerator path is on, measuring the end-to-end performance parameter of said regenerator path and comparing same with a margin threshold;

and

exchanging traffic between said source and destination nodes if said performance parameter is over said margin threshold.

22. A method as claimed in claim 21, further comprising abandoning said regenerator path if said performance parameter is under said threshold.

23. A method as claimed in claim 21, further comprising changing a wavelength of said set with an upgraded wavelength if said performance parameter is under said threshold and attempting again to setup said connection.

24. A method as claimed in claim 21, further comprising switching an additional regenerator in said regenerator path wavelength if said performance parameter is under said threshold and attempting again to setup said connection.

25. A method as claimed in claim 20, further comprising monitoring said performance parameter of all paths that share a link with said best regenerator path, during said step of turning on said best path.

26. A routing manager for a photonic WDM network comprising:

a routing module RM for constructing 'n' different valid link paths between a source and a destination nodes;

a regenerator placement module RPM for engineering 'm' groups of viable regenerator paths for each said link path, each said each said group having 'k' regenerators;

a wavelength assignment module WAM for assigning a set of wavelengths to each said viable regenerator path; and

a control unit for receiving a request for establishing a connection between said source node and said destination node and managing operation of said RM, said RPM and said WAM for selecting a best path available for said connection.

27. A routing manager as claimed in claim 26 wherein said RM constructs a path search tree based on node and connectivity data received from a topology database.

28. A routing manager as claimed in claim 27 wherein said RM constructs a path search tree based on constraints included in said request and received from said control unit.

29. A routing manager as claimed in claim 28, wherein said constraints comprises user defined performance and cost constraints.

30. A routing manager as claimed in claim 26, wherein said RPM constructs a regenerator search tree using said 'n' link paths form said database, and regenerator availability data received from a network resource utilization system.

31. A routing manager as claimed in claim 26 wherein said RPM constructs said regenerator search tree also based on user defined performance and cost constraints from said request.

32. A routing manager as claimed in claim 26, wherein said RPM estimates performance of all said regenerator paths using a Q calculator.

33. A routing manager as claimed in claim 26, wherein said WAM provides a set of wavelengths based on wavelengths rules, and user defined performance and cost constraints.

34. A method for automatically switching and routing a connection over a reconfigurable photonic network comprising:

maintaining updated information on status and operation parameters of a bank of wavelength-converter/regenerator devices connected in stand-by at a plurality of switching nodes of said photonic network;

investigating availability of said devices to locate a device based on said updated information; and

switching said device into a communication path according to a current performance parameter of said communication path.

35. A method as claimed in claim 34, wherein said performance parameter is Q.

36. A method of engineering a plurality of regenerator paths between a source node and a destination node of a photonic switched network comprising:

constructing a plurality of viable regenerator paths, based on current network topology data, operational parameters of all regenerators available in said WDM network, network loading data and user constraints; and

selecting a best path from said plurality of regenerator paths to serve said connection.

37. A method as claimed in claim 36, wherein said step of selecting comprises estimating an end-to-end performance parameter for each said regenerator path and ordering said viable regenerator paths according to said performance parameter.